EXHIBIT K

Ecogen and Evans Biocontrol: The Failure of a "Low-Risk" Strategy

Recently, the industry has experienced two discouraging developments: **Ecogen has downsized and is searching for a buyer, and Evans Biocontrol has completely shut down operations.** Both companies were involved in the development of biological controls of agricultural pests.

To many industry watchers, these events reflect the failure of biopesticides as a concept. To a traditional financial analyst, they simply represent the failure of high-risk, high-technology startups.

To us, however, these two companies were victims of a flawed strategy—ironically, one that was too conservative rather than too ambitious. Both these companies sold microorganisms that had known pesticidal effects in nature and thus did not have to be "developed" per se. This was touted as a great advantage to investors, since they could participate in "biotechnology" without worrying about any bothersome technical glitches interfering with getting the product to market. Both companies made much of the fact that they had very little involvement with genetic engineering.

The flip side of such a strategy, however, is that such products that do get to market are unlikely to be blockbusters. Agricultural chemicals are a tough act to follow: they're cheap and effective. The chief merit of biocontrol products is that they are safer, but to challenge agricultural chemicals, they will have to be cheap, effective, *and* safe. Simply bringing already isolated pesticidal microorganisms to this competitive market distracted the companies from development of truly innovative products and thus, in our view, doomed them.

We believe that biotechnology companies should take risks in product development. They might not succeed, but that at least gives them a chance. The "conservative" strategy of avoiding adventurous development efforts virtually ensures failure.

Biotechnology's "Benevolent Vultures": Opportunity for the 1990s

"There is a tide in the affairs of men, which taken at the flood, leads on to fortune."

As noted above, David Blech has stepped in with a capital investment of $1.5 million in Ecogen, which was down to six months' operating capital and as a result was forced to cut much of its research and marketing operations. A founder of DNA Plant Technology, Blech was one of the first venture capitalists to invest in agricultural biotechnology.

We have long been impressed by Blech, and, to us, his investment in Ecogen is further evidence of his perspicacity. For his $1.5 millon he now owns 10% of Ecogen and sits on its board and has the opportunity to purchase more. And although we believe that in many ways the company's strategy was fundamentally misguided, at bottom, Blech's investment buys him a lot of technology and infrastructure, for cheap.

Investing in troubled companies is all the rage on Wall Street these days, and the biotechnology industry may now have its counterpart. **The current cash-starved environment offers a smart venture capitalist—Blech or someone else—the lucrative opportunity to gain access to technology at steeply discounted prices.** Such investing requires judgment, of course, but in our view the investor who takes advantage of this opportunity will be the one who makes it big in biotechnology in the 1990s.

Keystone Crops

During the Keystone Conference on Molecular Strate-es for Crop Plant Improvement sponsored by UCLA in eystone, Colorado, April 16-20, **two groups announced success in the long-sought-after-feat of transferring genes into corn,** and producing fertile plants capable of passing along the new genes to subsequent generations.

These reports followed that from BioTechnica, which made a similar announcement in January, with fewer technical details. The **monocot barrier** is at long last being bridged. Monocots besides corn include wheat, rice, and other cereals—their genetic engineering will have a significant impact on agriculture—although much work remains to be done.

On April 16, molecular biologist Michael G. Fromme of the USDA/ARS Plant Gene Expression Center, Albany, California, and Charles L. Armstrong of Monsanto, St. Louis, Missouri, described their work using two marker genes. Armstrong developed the laboratory cultures of corn cells that took up genes from a "gene gun."

Rob Fraley, director of plant science technology at Monsanto (which funded part of the Albany research), said that the "highly productive venture and excellent example of **collaboration between industry and the USDA**" has been a success that "represents the beginning of important new advances in our understanding of cereal plants' biology, and should lead to better crops for the future."

At Albany, Fromme and colleagues constructed and linked two marker genes, one that allows corn cells to grow in the presence of an inhibitor and one that triggers corn cells to make small amounts of light. The gene gun propelled genes into corn cells in petri dishes; corn cells that required the gene were cultured into mature plants that were then fertilized with pollen, and a special low-light-detection machine was used to discover that half of the seedling generation produced made light, indicating that the gene transfer had been successful. Fromme noted that this set of tasks was not easy: "It took several years of intensive research at our laboratory and other laboratories to overcome all the obstacles."

Federal labs in general have often been criticized for failing to contribute to technological innovation and the competiveness of the U.S. private sector. When asked if the collaboration with Monsanto as a private company posed a problem for the USDA/ARS Center, Director Gerald Still said emphatically, "Not at all! We developed a technology transfer agreeement up front, so everyone knew who owned what and who would do what." In fact, Still went on to explain, the Plant Expression Center has had technology transfer as a core mission since 1980, when the Center's consortium concept was developed. "We feel very strongly that what we do needs to one day impact real world agriculture. We need to take our technology and then drive it into the field." Still's consortium concept is itself driven by science, not by membership checks. A potential consortium—or collaboration—member is asked two questions: What is the problem you are trying to solve, and what can you bring to its solution? The puzzle pieces—who does what to attack the problem—are put together, and funding arrangements follow.

The transformation of monocots was a high priority for the Center. The approach included at least three dimensions: the Monsanto embryogenic suspension culture work, the USDA/ARS Center gene transfer work (including the ballistics work of Ted Klein, brought in from Cornell), and participation by an undergraduate from UC—Berkeley. Still looks ahead to putting together similar consortia of talent for wheat, barley, and oats, bringing participants together as needed. This is consistent with his view of the Center's overall mandate: "We look ahead to where the next frontier is, and position our program to get it there."

During the same weeklong conference, on April 18, the DeKalb Genetics Corporation announced that its biotechnology research program had produced fertile transformed corn plants, transgenic plants capable of passing along the newly acquired genes. DeKalb scientists, for its seed business DeKalb-Pfizer Genetics, used a Biolistics gene gun to shoot microscopic bullets coated with an herbicide-resistance gene into cultured corn cells. Cells that incorporated the gene were identified by their resistance to the herbicide bialaphos. Catherine J. Mackey, director of the biotechnology research team, noted that "the significance of our research is that the transferred trait has been passed on to subsequent generations of corn . . . **it is the development of a general method for introducing genes for any desirable trait that is particularly exciting.**" She too emphasized the many years of research required to achieve this success. Their research results will be published in the July issue of the journal *The Plant Cell*. Despite the excitement over this critical stage, Dr. Thomas B. Rice, president of DeKalb-Pfizer Genetics, cautions that, even though the company is preparing a USDA application to field-test the transgenic corn lines, **genetically engineered corn products will not be ready for marketing for several years.**

The Bottom Line: Well, more heard from in agricultural biotechnology's run for the roses—corn transformation. As we have observed earlier in this space, stable transformation of maize has always been the Holy Grail of agricultural biotechnology. Now Monsanto, the USDA, BioTechnica, and DeKalb follow CIBA-GEIGY and DNAP in announcing further success toward this elusive goal.

As great proponents of the industry in general, we are always eager for positive developments, but are disinclined to get all excited now, despite the splashy publicity. We maintain that **transformation capability is useless in the face of the paucity of genes for economically worthwhile traits**—in other words, who cares if you can transform corn if you have nothing to transform it with? Gene isolation is severely lagging transformation technology and must catch up if the technology is to proceed.